Insights

A publication of the Ontario Forest Research Institute

Welcome to Insights! *By David DeYoe, OFRI General Manager*

Insights is a look to the future of our forests — and to how research can provide tools, methods, policies and practices to help resource managers make sound decisions for achieving their forest management objectives in an ecologically sustainable manner. Building on a 50-year tradition of practical forest research in this province, the Ontario Forest Research Institute is committed to serving its clients with quality products and services and timely delivery.

This publication will focus on products or services that are available now or will be soon. You will receive relevant information on applying herbicides and pesticides, managing ecologically sensitive sites, maintaining genetic and ecological diversity, optimizing forest ecosystem productivity, implementing complex land-use planning decisions, and more. *Insights* will help you keep in touch with the broadening spectrum of management tools and information arising from OFRI's sustainable forestry research.

We hope you find this first issue of Insights to be informative and useful, and we welcome your comments and suggestions for future issues.

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Cette publication technique n'est disponible qu'en anglais

Eastern white pine: protecting Ontario's provincial tree

By Jocelyn Watt

Reaching 49.4 m into the sky, Ontario's tallest recorded white pine contains enough timber to build a comfortable 3-bedroom home. So imposing is this tree that the nearby town of Thessalon has built a tourist attraction around it.

Eastern white pine is, after all, Ontario's official tree. The species once dominated the forest landscape, but logging, fire and silvicultural inattention over the past century have vastly diminished its presence. White pine holds significant economic and emotional value for Ontario's citizens. Conservationists see it as emblematic of old-growth forest and the province's history. Native culture reveres the soaring giant, which represents the link between earth and sky. Ecotourism promotes its singular beauty to attract visitors. Industry and its communities rely on the tree's value as a wood product.

As resource management plans increasingly support biodiversity and sustainable ecosystem objectives, the pressure is mounting for forest research to deliver new information for restoring and conserving white pine. Read on for the latest in white pine research.

Saving parent trees

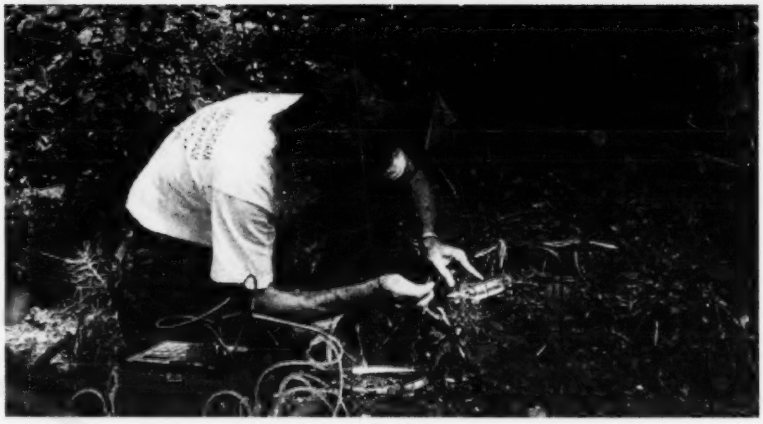
OFRI genetics researcher George Buchert views old-growth white pine stands as nature's portals to the genetic past.

"The pristine gene pools present in virgin, old-growth stands are critical for continued adaptation and evolution in constantly changing environments."

Consequently, Buchert says, the interface between genetics and silviculture is a critical area for sustainable forest management. He asserts that any stand disturbance that removes healthy parent trees and leaves only smaller, poorer-growing white pine may favour deleterious genes.

In the Chapleau, Sault Ste. Marie and Blind River districts, Buchert is assessing the genetic diversity (a measure of the number of genes that exist in a given population of trees) of old-growth stands before and after harvesting. He is con-cerned about the degree of gene pool "degradation" that may occur if harvesting practices leave large spaces and trees with poor crown form, thus encouraging inbreeding in the stand. Inbreeding degrades the gene pool, causing losses in seed set, vigour and tolerance to pests. His results indicate that such harvesting can in fact reduce the original gene pool by 25% or more. This information will go a long way in helping forest managers decide how to restore and conserve Ontario's old-growth white pine.

"It is imperative," he says, "that old-growth silvicultural practices are based upon knowledge of population genetics and the evolution of natural stands. Such practices might include leaving dominant parent trees standing during harvest, re-establishing stands through natural regeneration before harvesting, and thinning to remove poorer-growing trees."



In the Kirkwood Forest study, scientists are monitoring how white pine adapt physiologically to increased sunlight after competing vegetation is removed.

An ecosystem restoration story

To date, the white pine regeneration story hasn't had a very happy ending, says OFRI's Tim Meyer, provincial forest pathologist. Today, however, forest health scientists are rewriting the script. Three arch villains — white pine weevil, white pine blister rust, and white pine's inherent slow start and poor ability to cope with competitive vegetation following logging — create the central conflict in the story. The hero that overcomes them all and saves the day may be of all things, a timed-release "pill," which can be planted with the seedling. One study of this pill is taking place in the Temagami area, another near Algonquin Park.

"In the Temagami area, the white pine ecosystem was fundamentally changed by logging. To restore it back to pine requires intervention."

For Meyer's study of this "miracle" pill, he developed a partnership with the Temagami First Nation, which wants to restore white pine to the ecosystem. Other partners include Vigoro Industries and the Canadian Forest Service.

Meyer explains that this pill is stimulated by the same soil conditions that trigger root activity. Its timed-release feature delivers a fungicide and an insecticide to fend off weevil and blister rust; fertilizer is also released to give seedlings an edge against competing vegetation. Unlike a spray, this capsule delivers a precise application for the exclusive use of the target species. It also eliminates worker-exposure problems.

It is hoped that the treatment will create a 5-year "window" in which the young trees can establish themselves in a stand. So far, the results are promising. "In the first year of the study, there was a significant reduction in transplant shock and mortality," says Meyer. "Now in their third year, the white pine are growing more quickly than the control trees." He adds, "The method is effective because it gives the tree what it needs, when it needs it."

Giving young white pine a competitive edge

"Little has been done to understand the physiological stress experienced by young white pine when they must try to survive under competitive vegetation," explains Wayne Bell, a vegetation management scientist at

OFRI. Bell is involved in a study in the Kirkwood Forest near Thessalon that is determining which of 3 species — bracken fern, beaked hazel and balsam fir — compete most aggressively with white pine seedlings. Results indicate that bracken fern has less negative shade effect on seedlings than the other 2 species.

"We looked at the biological aspects of vegetation management," says OFRI ecophysiology scientist Bill Parker, who is Bell's collaborator. "Although heavy shading results in reduced growth rate, a little bit of shading can benefit young pine trees by providing shelter from microclimate extremes. Sheltering may also reduce some of the adverse physiological effects of sudden exposure to very high light levels following the removal of competing vegetation."

Andrée Morneault, a vegetation management specialist with the Central Region Science and Technology Development Unit, is coordinating another white pine study, which is investigating the biological and ecological effects of vegetation treatments on both planted and naturally regenerated white pine seedlings in the Parry Sound District.

She explains that white pine stands are often harvested using the uniform shelterwood cutting system, and after harvesting, site-preparation treatments can enhance natural regeneration by providing a seedbed and microclimate favourable to germination and establishment.

However, she notes, "Site preparation treatments are significant costs at a time when silviculture budgets are limited. Thus it's important to identify whether mechanical and chemical site-preparation techniques are effective." What's more, she asserts:

"The public is increasingly concerned about the effect of forestry activities on components of the ecosystem."

As a result, the interdisciplinary research team involved in the study, including scientists Bell and Parker, is also measuring how each treatment affects salamanders and carabid beetles, as well as the seedlings. Salamanders represent small non-game species, and carabid beetles are good indicators of biodiversity because they eat a wide variety of other insects.

New knowledge gained from these studies will enable forest managers to weigh the costs of site preparation and vegetation management against the physiological and environmental effects on white pine regeneration. Other partners in the project include the Petawawa National Forestry Institute and MNR's Parry Sound District.

Editor's note: For more on white pine, see the article that follows, as well as "Smarter Old-Growth Pine Management" on Page 6.

"Old-growth forest" discovered in Algonquin Park lake

By Abigail M. Obenchain

Most people wouldn't think twice about dragging a slimy old log out of the water in front of their cottage. What they don't know is that the log could be 800 years old. In addition, its removal could have serious consequences for speckled trout in the lake, as well as for the whole ecosystem, says OFRI forest ecology scientist Bill Cole, one member of an interdisciplinary team of scientists who are studying forest-lake ecosystems in Algonquin Park. He explains that many of the logs in one lake in the Park are indeed up to 800 years old — and will probably still be there after our great-great-great grandchildren are dead.

"One white pine log we sampled came from a tree that germinated about 1190, died in the early 1500s, and has been lying in the water ever since," he says. "The wood is remarkably free of decay, and you can even still see the bark. This log will easily remain intact for several hundred more years. If it had fallen on land, it probably would have disappeared within 150 years."

Many of the other sampled logs came from trees that germinated between 1400 and 1500, died between 1650 and 1800, and show little or no decay. "We were really thrilled with these results," Cole says. "It's amazing to think that individual trees can play a role in this ecosystem, first on land and then in the water, for a thousand years or possibly even more. It's like an old-growth ecosystem under the water. What's also very interesting is until now we did not have very good evidence that white pines could live past 300 years in this area."

Do trout swim in the forest?

MNR scientist Mark Ridgway, who is based in Maple and coordinates the fisheries research at the site, also likens the woody debris along the shoreline to a forest in the water. "The young-of-the-year brook (also known as speckled) trout need this complex structure of debris to protect themselves from adult trout, which would otherwise cannibalize them," he says.

This debris also helps break up waves and thus protects shoreline vegetation. As Ridgway recently discovered, when this vegetation is

In Algonquin Park's Swan Lake, logs up to 800 years old are providing habitat for young trout, as well as other animals and plants. (Drawing: Rich Guyette)

flooded in early spring, it becomes an important feeding area for the young trout, which swim among it and forage for springtails, a soil microorganism.

Giving old logs a "birthday"

To date the logs, Cole enlisted the help of University of Missouri dendrochronologist Richard Guyette. Using core samples from living old-growth trees at a nearby site, he graphed the growth pattern of each tree over time. Most of the trees share numerous "signature" years where growth was either very poor or good. From these individual growth patterns, Guyette created a "master" tree ring chronology for area white pine that dates back to 1650.

Then he aged the lake logs by overlapping each of their growth patterns with the master chronology and determining where they match. Through this process, he was able to extend the chronology back to the late 1100s. "We have 100 new samples that we took this past summer, and I think we'll be pushing this chronology back even farther," Guyette says.

According to Cole, the woody-debris study is not the only one taking place at this lake site. Eighteen studies are looking at topics ranging from which plants and animals live in the riparian zone to how water and nutrients flow through the ecosystem and nurture its inhabitants. The goal of this work is to help resource professionals make wiser decisions for managing these important areas.

The forest-fish connection

"In Ontario, we have more than 250,000 inland lakes, most of which are surrounded by forest," Cole says. "Unfortunately, in the past, forests and fisheries were generally studied and managed separately. Now we are working together to understand how what happens on shore affects the lake and vice versa, and to determine how we can manage these ecosystems in a sustainable way."

He adds, "These are just early results, but I think it's obvious we have to think long and hard about removing dead trees from shoreline areas when their ecological 'life' is hundreds or even a thousand years long and is clearly important to ecosystem inhabitants."

How new GIS-based tools are improving forest management

By Abigail M. Obenchain

Ask a GIS expert to define geographic information system, and you'll probably hear, "It's a system of computer hardware and software that allows the user to store, access, analyze, manipulate, layer, display and map a broad range of geographic-related information at different scales."

But what does GIS mean for forest managers? For them, it is an efficient, flexible tool to use in deciding how to manage the resources in their area. Eventually, GIS will allow them to coordinate local decisions with those made at regional, provincial and perhaps even global levels, and to link forestry data with that from fisheries, wildlife, recreation and other related areas. GIS enables a big-picture approach to planning that helps account for all values and manage in a sustainable framework.

Creating a useful GIS is an enormous task. First, a broad range of geographic data must be collected and fed into the system, including locations/boundaries of the following: forest cover types, topographical features, harvests and burns, points of public access, bodies of water, climate patterns, road systems, land ownership, wildlife corridors.

This data is gathered many different ways: in the field, from existing data sets and maps, from aerial photos, and through satellite technology. It's a lot of work up front, but it will allow the user to work wonders at the other end.

Here's a greatly simplified example. Through field research, scientists learn that a certain hawk species prefers mixed hardwood cutover areas with no more than 2 km of road per hectare, at least 10 km of waterway, and the presence of 5 species of small mammals. Using GIS to layer vegetation cover, harvest, road, waterway and small mammal patterns, the scientists quickly and efficiently pinpoint other areas across the region that suit this species. Without GIS, this task would be difficult and very time-consuming.

OFRI and its many partners are working on a wide range of GIS-based forest management tools. Following is information on 3 of them.

A new era of seed zones

In 1994, OFRI and the Canadian Forest Service completed a GIS-based bioclimatic computer model. One application of this model is a process that divides the province into homogeneous climatic regions and provides a strong scientific foundation on which to base decisions for matching seed source with planting site. Thus began a new era of seed zones in Ontario.

With this model in hand, scientists then created **SeedWhere**, GIS-based software that MNR regional forest genetics specialists are using to help make sure seedlings are planted where they will thrive. As OFRI conservation specialist Brad Graham points out, ensuring accurate matches has become even more important today, given the tighter budgets and the increasing urgency to conserve genetic diversity.

How does SeedWhere work? Imagine that you need to regenerate a harvested area. First, you enter the area's longitude and latitude into SeedWhere. Then the software produces a map and a table that show which other areas in the province have a similar climate, based on variables like growing season length and mean annual temperature, and thus are appropriate places to collect seed for the area in question.

According to Graham, SeedWhere can also analyze how far away to plant seed you have in stock, and it can rank seed lots on their appropriateness for a given site. These functions could be used to broaden the range of a genetically unique population of trees, to restore a threatened species that now occupies only a fraction of its former range, or to determine where to plant genetically improved seed.

This new technology is a vast improvement over the old seed zones, says Southern Region forest genetics forester Barb Boysen. In use for the last 20 years, the old zones were set up based on patterns that former OFRI scientist Angus Hills detected through his pioneering site classification work, as well as on administrative boundaries.

Although innovative in their time, the old zones have their limits. "They do not reflect that something that is close geographically may be far away biogeographically," Graham explains. In other words, because of localized climate variations, seed collected in your backyard may grow better at a site 100 km away than it does at a site just over the next hill. Today, GIS technology enables Ontario's new seed zones to reflect these local variations.

Giving FRI maps an ecological focus

Forest planners and managers use forest resource inventory (FRI) maps to make the wisest decisions possible to enhance the timber resource. Today, however, ecosystem-based forest management is the watchword. For this, resource professionals need ecologically based mapping.

In the MNR's Northwest Region, from Terrace Bay west to the Manitoba border, districts should begin receiving this mapping in 3 years. According to provincial ecologist Peter Uhlig, this new generation of GIS-based FRI maps will cover wetlands and young forests as well as mature forests. It will be based on provincially standard ecosite types developed by the Ecological Land Classification (ELC) Program, not just on stand cover classes.

The benefits will be many, says Murray Radford, an MNR FRI specialist based in Sault Ste. Marie. "The GIS part of this project means we won't routinely have to re-do the maps from scratch. GIS makes it easy to update stands or add post-harvest information or new roads." He adds, "It also gives us continuous and pertinent mapping of the forest and wetlands, so we can manage much more than the forest production component."

Project partners include the ELC Program, part of the Terrestrial Ecosystems Branch, housed at OFRI; the Natural Resources Inventory Section, also in Sault Ste. Marie; and the Northwest Science and Technology Unit in Thunder Bay.

How to get OFRI publications

OFRI is publishing a 50th Anniversary annotated bibliography in early 1996. It will provide a comprehensive list of all OFRI publications from 1945 to 1995. For more information on this or any OFRI publication, contact us at the address listed at the bottom of Page 8.

Smarter old-growth pine management

Two years ago, OFRI released GRASP, or GIS-Based Ranking System for Pine, which is helping resource managers and planners to decide how to manage Ontario's remaining old-growth red and white pine.

According to provincial landscape ecologist Ajith Perera, GRASP is a self-standing, desk-top GIS with integrated software, data and user logic. It allows the user to layer different kinds of spatial data to determine which old-growth stands are suited for preservation, harvest, wildlife habitat, or multiple objectives and to link local and provincial planning and decision-making.

Just some of the data included: the locations and characteristics of old-growth red and white pine stands, roads, cutovers, burned areas, and water bodies — as well as information on elevation, soils and geology.

Imagine, for example, that an MNR district wishes to manage its old-growth pine for wildlife habitat. According to OFRI GIS analyst Dave Baldwin, this district can use GRASP to determine where its old-growth pine stands occur, and then rank them on their suitability for wildlfe preservation according to certain criteria.

In this case, the criteria may include the size of the stand and the number of kilometres of roads and cutovers in or near the stand. "Before GIS, this kind of task would be a huge undertaking," Baldwin says. "You could probably do it only once for one set of criteria. Now you can run numerous analyses in a single day."

GRASP was developed in partnership with MNR regional staff as well as DigiMap Data Services.

OFRI lab wins award for excellence

On October 19, OFRI's Stock Quality Assessment Lab received one of 4 Government of Ontario Analytical Laboratories System (GOALS) Awards for Excellence in Laboratory Service.

Before 1992, those responsible for provincial forest regeneration programs had no way to know if seedlings they planted were healthy. To address this problem, OFRI's seedling research team, led by scientist Steve Colombo, developed sophisticated new physiological tests to assess seedling health and vigour. They have also adapted tests developed by other researchers.

Working in partnership with MikroTek Labs in Timmins, OFRI has operational programs for both Seedling Certification and Problem Stock Testing (for when nursery managers suspect the health of a crop may have been compromised).

According to OFRI stock quality assessment coordinator Paul Sampson, more than 1100 stocklots, representing about 168 million seedlings, have been tested in the last 3 years. More than 3 million were prevented from being planted after being identified as dead or low vigour, resulting in a savings of about $2 million.

Research in the regions

By Abigail M. Obenchain and Lisa J. Buse

Partnerships with MNR regional staff (and many others!) are critical to the success of OFRI's many projects. Following is a sample of our current cooperative ventures.

Southern Region:
Mapping genetic variation

South of Simcoe, on private land within sight of Lake Erie, lies a field of 2-year-old red oaks that were grown from seeds that were collected all over the Ontario range of this species. Researchers are seeing how well trees from various sources perform here — as well as at harsh sites near Sault Ste. Marie and Chapleau — over a period of 5 years. The results will reveal how closely red oak is adapted to its local climate and what risks might be involved in moving seed to areas with different conditions.

Undertaken by OFRI and the Southern Ontario Forest Gene Conservation Association, this project is the first of its kind in the world to map adaptive variation of a hardwood species, says MNR provincial geneticist Dennis Joyce. According to MNR Southern Region forest genetics forester Barb Boysen, next spring the site will be developed as a demonstration area to educate people about the potential risks of using seeds from other than local sources. Other major project partners include the Eastern Ontario Model Forest and MNR Simcoe Area staff.

Central Region:
Monitoring and modelling the white pine forest

On Crown land, in the Parry Sound District near Grundy Provincial Park, is one of the first white pine

shelterwood cuts, a 51-ha site that has special appeal for Central Region forest growth and yield coordinator Murray Woods. White pine is an important economic species in this region, he points out, and shelterwood cuts like this one are demonstrating a forestry success story. "The site was cut in 1981, and now when you walk through there you see large residual trees and the regeneration, which has grown above your head."

This past spring, a standard Ontario forest growth and yield plot was installed on the site. Data collected here is being linked with data from more than 120 other Central Region white pine plots, chosen to reflect various managed and unmanaged conditions. Nineteen of them date as far back as the '50s and have been thinned up to 3 times. The plots are also part of Ontario's forest growth and yield plot network, the database for which OFRI is managing.

According to Woods, a wide variety of data will be collected at the site every 5 years, ideally for up to 100 years, including the numbers of live trees and tree heights/diameters; numbers/classes of standing snags and downed woody debris; numbers of nesting and feeding cavities; assessments of regeneration, vegetation, and soils. Also being assessed: how harvesting affects both the residual trees and regeneration. The data is being used to create computer models that forecast how the stands will grow and change over time, Woods says.

Project partners include the Central Region Science and Technology Development Unit, OFRI, and the Parry Sound District.

Northeast Region: *Modified harvesting reaps forest diversity*

Boreal mixedwood research and education are coming together in the Lake Abitibi Model Forest north of Iroquois Falls, reports OFRI silviculture scientist Blake MacDonald. The research component of the project, now in year 2 of 10, is determining how modified harvesting can ensure a diversity of tree species regenerates on boreal mixedwood sites.

The harvest treatments, conducted by Norbord Industries on the 20 ha research site, removed either none, a third, two thirds, or all of the overstory. The set of cuttings was replicated 4 times using "careful logging," which involves harvesting in winter, keeping to defined trails, protecting young spruce from damage, and using specially trained operators. Early results: Overall, the modified harvesting greatly improved spruce regeneration. (However, the remaining spruce are vulnerable to windthrow in the heavily cut treatments.) Partial cutting was 15 to 20% slower than clearcutting yet it was economically feasible.

By June 1996, a self-guided walking trail will open at a 5-ha mixedwood-management demonstration area in the Model Forest. Located in Edwards Township, this site received 1 replication of the treatments last winter. OFRI staff are working with forest habitat specialist Bob Watt of the Northeast Science and Technology Unit to create signs and a brochure for the tour, which will focus on the ecology of mixedwood management, including how it can positively affect wildlife habitat. For example, Watt points out, when harvesters leave aspen snags and fallen woody debris, woodpeckers and small mammals respectively benefit.

Northwest Region: *Seeking herbicide alternatives*

The Norwesters, located southwest of Thunder Bay, are home to the Fallingsnow Ecosystem Project. Established in 1993 by OFRI vegetation management scientists Wayne Bell and R.A. Lautenschla-

People trust what the MNR says, survey reveals

A new survey commissioned by OFRI has revealed how the people of Ontario view forest and vegetation management. Did you know, for example, that . . .

. . . the citizens of Ontario overwhelmingly support environmental protection?

. . . forest management practices supported by the public include restorative management and non-chemical vegetation control?

. . . environmental values strongly influence both people's perception of risk and their acceptance of forest management practices?

. . . the MNR is trusted as a source of information for environmental-related issues?

The results of this survey are summarized in the publication titled Vegetation Management in Ontario's Forests: Survey Research of Public and Professional Perspectives. To get a copy, contact Lisa Buse at OFRI.

ger, this project is documenting the ecological effects of alternative conifer release treatments; providing quantitative measures of biodiversity in managed northern forest ecosystems; and offering an example of how cooperative research can address forestry problems.

According to Bell, 1 year after applying the treatments, the data indicates that herbicides decreased plant-species richness more than cutting (16% vs. 8% less richness than in untreated areas). However, the treatments had little effect on populations of insects, slugs and snails, or frogs and snakes. Songbird and small mammal response to treatment varied by species: Some increased, some decreased, and others remained unchanged. Second-year results are now being summarized, Bell says.

Cooperators in this project include: Thunder Bay District, Northwest Science and Technology Unit, Canadian Forestry Service, Lakehead University, University of Guelph, Forest Engineering Research Institute of Canada, Superior Botanical Explorations, Dow Elanco Canada, Monsanto Canada, Haveman Brothers Forestry Services, and Sure-way Aerial Applications.

Upcoming events

> LUSTR Co-op Meeting, Thunder Bay, Ontario, Jan. 7-9, 1996. Focus: Forest policy and the seedling grower; container root systems. Contact: Irwin Smith, Biology Dept., Lakehead University, Thunder Bay P7B 5E1, phone (807) 343-8933, fax (807) 346-7796.

> Vegetation Management Strategies Workshop, Wawa, Ontario, Jan. 16-18, 1996. For field staff who wish to link vegetation management strategies to FEC site types. Contact: Alison Luke, (705) 360-8228.

> Ecological Monitoring and Assessment Network 2nd National Science Meeting, Halifax, N.S., Jan. 17-20, 1996. Includes session on long-term productivity trends in agriculture, forests and lakes. Contact: Ecological Monitoring Coordinating Office, 867 Lakeshore Road, P.O. Box 5050, Burlington, Ontario L7R 4A6, phone (905) 336-4414, fax (905) 336-4989.

> Genetic Resource Management and Conservation Workshop, North Bay, Ontario, Feb. 7, 1996. For field staff and district/regional specialists in MNR Northeast and Central regions. Contact: Brad Graham at OFRI; Joan Wild, Sudbury, (705) 675-4120; or Randy Ford, Swastika, (705) 567-3372.

> National Model Forest Network Meeting, Cochrane/Iroquois Falls, Ontario, Feb. 18-22, 1996. Contact: Erik Turk, phone (705) 258-4278, fax (705) 258-3350, e-mail lamf@emr.ca.

> CIF 88th Annual Meeting, Thunder Bay, Ontario, Aug. 18-22, 1996. Focus: Global Influences, Local Realities. Contact: Peter Street, Conference Chair, 17-2 Court St. S., Thunder Bay P7B 2W3, phone (807) 344-5190, fax (807) 344-8499.

> 7th North American Caribou Conference, Lakehead University, Thunder Bay, Ontario, Aug. 19-21, 1996. Focus: Research and management of both woodland and barren ground caribou. Contact: Gerald Racey, Co-Chair, 7th North American Caribou Conference, c/o Ministry of Natural Resources, RR# 1, 25th Sideroad, Thunder Bay P7C 4T9.

Have a suggestion? Want more information on a research project? We want to hear from you!

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